

Integrated Occupational Program

Mathematics 16-26

Program of Studies

Grades 10 and 11


INTERIM 1991

CURRICULUM

courses for Grades 8, 9, 10 and 11 have interim approval and are being
ed as follows:

- QA d 9 - Provincial implementation, September 1989
- 14 - Provincial implementation, September 1990
- C22 - Provincial implementation, September 1991.
- A3
- A3143
- 1991
- gr.10-11

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IOP MATHEMATICS 16-26 GRADES 10 AND 11

A. PROGRAM RATIONALE AND PHILOSOPHY

RATIONALE

In recognition that the needs of both the individual and society may best be served through school experiences tailored to meet student needs and abilities, the *Secondary Education in Alberta* (1985) Policy Statement directs that a program be developed for students who continue to experience difficulty in learning. This program, beginning in Grade 8, will be known as the Integrated Occupational Program and will be articulated with a similar program in the senior high school. The policy statement states that:

"... the goals of the secondary schools are to assist students to ... become aware of the expectations, and be prepared for the opportunities of the workplace - expectations that will be faced as employees or employers; expectations that will be faced as entrepreneurs or volunteers..."(p. 12)

"Opportunities must be provided to involve the community in secondary education programs and to recognize and support learning experiences which take place outside of schools." (p. 8)

The policy statement further directs that:

"The Certificate of Achievement will be awarded to those students who, because of their abilities and needs, have taken the Integrated Occupational Program. The certificate will

recognize their achievement in that program." (p. 23)

The Integrated Occupational Mathematics Program provides a two-course sequence in mathematics known as Mathematics 16-26. Mathematics 16 allows students to meet the credit requirements of the Certificate of Achievement. Mathematics 26 allows students to develop their knowledge and skills in mathematics more fully, and facilitates transfer to the General High School Diploma Program.

The IOP Mathematics 16-26 Program provides for the development of essential concepts, skills and attitudes required for effective computation and problem solving. The program is activity-based, and addresses the need for students to be able to transfer and apply specific mathematical concepts and skills to more generalized situations in everyday life and the world of work. The program is intended to foster an appreciation of mathematics for its usefulness and relevance, and thus motivate students to participate in the learning process.

Students need to be able to cope with the rapid pace at which change occurs in both home and work environments. A focus on effective strategies for problem solving will assist students to develop thinking skills and solve problems in new and unfamiliar situations. Students also need to understand applications of calculators and computer technologies in everyday situations involving computation and

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problem solving. Time spent learning mathematics can no longer be limited to practising long repetitive or tedious procedures that are more efficiently accomplished with a calculator. A focus on the use of technology throughout the mathematics program will enable students to use calculators and computers in performing routine tasks more easily replicated by these technologies. The demands of daily living require ability to perform computation using several different methods, including mental arithmetic, estimation, the calculator and paper/pencil. A focus on computational facility and estimation skills will assist students to select and use computational procedures that are appropriate in a variety of practical situations.

Students are often unaware of strategies they may generate and employ to become more efficient in their cognitive functioning. Evidence supports, however, that students with learning difficulties can perform strategically if taught to do so. Thinking strategies that foster effective behaviours in planning, organizing and self-monitoring are emphasized throughout the program. As students learn to understand and control the outcome of tasks demanded of them, confidence in taking risks and accepting challenges will further their ability to solve problems and make informed decisions in everyday life.

Prescribed content within Mathematics 16 and 26 reflects an emphasis on life skills, and has been determined on the basis of the abilities and needs of students for whom the courses were designed. Nevertheless, the philosophy, goals and directions established in the Integrated Occupational Mathematics Program are consistent with those of other regular program mathematics courses. This continuity will assist students in their transition from regular program courses into IOP, and will also facilitate potential transfer of some students from the Mathematics 16–26 program back into regular program mathematics courses.

PHILOSOPHY

The need to develop programs for students with exceptional needs rests on a fundamental belief about children, as expressed in the government's *Secondary Education in Alberta* (June 1985) Policy Statement: "... a respect for the unique nature and worth of each individual" (p. 7).

The Integrated Occupational Program also rests on a number of further beliefs and assumptions about the way children learn, the overall potential of children, and their learning needs in relation to societal demands. These beliefs and assumptions have a tremendous impact on program goals, design and implementation.

There are patterns and predictability to children's learning sequences. However, each student's style and pace is unique, reflecting past experiences. Though seen as "exceptional" in their learning needs, these children nonetheless fall within the normal range of learning potential; thus every effort must be made to offer experiences that provide equitable opportunities to participate in all aspects of life.

The Integrated Occupational Mathematics Program focuses first and foremost on the needs of the learner. As attitude and self-esteem are powerful influences over learning, the program must foster in each student a positive self-concept and a positive attitude toward learning. The concepts, skills and attitudes addressed within the program must:

- provide meaningful and relevant learning experiences
- be appropriate to student ability
- provide for student success.

Students vary in the way they receive, process, recall, apply and communicate information. Each student has a preferred way of approaching learning tasks. Instructional planning must include careful assessment of each student's developmental characteristics, knowledge, skills and preferred way of learning. In order to ensure that individual student needs are being met, instructional plans may often need to be adjusted or modified.

An integrated approach suggests the linking together of various mathematical skills and strategies into meaningful activities and applications. Abstract concepts and ideas will take on new meaning and significance to students when applied to daily experiences. Organization of mathematics instruction into “themes” is intended to advance the notion of “holistic” learning, relative to both mathematics and the student. Discrete skill instruction is appropriate when specific deficiencies are noted.

Although students are at various stages of cognitive development, most will continue to use concrete operational thinking. Students will depend on personal experience and personalized content to link new ideas with prior knowledge. As the process of analysis must be based on tangible experience, learning activities should begin at the concrete level. High emphasis should be placed on experiential learning involving manipulatives and hands-on activities. Specific concepts and skills should be developed after establishing a need for their use through learning activities involving three levels of instructional technique:

- concrete (e.g., use of models)
- transitional (e.g., pictorial representation)
- formal (e.g., symbolic representation).

Direct assistance must be provided to the learner in progressing from the concrete level of thinking to the more abstract thought processes. Appropriate strategies for providing this assistance have been included in the *Program of Studies/Curriculum Guide* and corresponding *Teacher Resource Manual* (available for each course from the Learning Resources Distributing Centre).

The mathematics program must address the realities of today's society in developing the concepts, skills and attitudes that students will use in everyday life and the world of work. The demands of daily living suggest the program place emphasis on the:

- development of number sense and computational facility
- use of technologies such as the calculator and computer
- application of what is learned to a variety of problem-solving situations within a changing society.

These learning goals suggest a broader context for instruction in mathematics, and provide a focus for learning activities that are suggested throughout the program.

B. GENERAL LEARNER EXPECTATIONS

The Integrated Occupational Mathematics Program is designed to assist students in developing and maintaining:

- positive and realistic self-images
- constructive relationships with others
- positive attitudes toward mathematics and lifelong learning.

Within the Mathematics 16–26 course sequence, students will be expected to:

- develop the essential concepts, skills and attitudes of mathematics that are required for responsible participation in the home, the school, the community and the workplace
- apply mathematical concepts and skills to daily life and occupational situations that are experienced both inside and outside the mathematics classroom
- develop critical and creative thinking skills, and apply these skills through a problem-solving process to a variety of practical situations
- develop the ability to use technology in its various forms
- develop communication skills that are used when learning mathematics and solving practical problems.

Specific Learner Expectations

Specific learner expectations (learning objectives) have been identified for Mathematics 16 and Mathematics 26 in the Statement of Content, which follows.

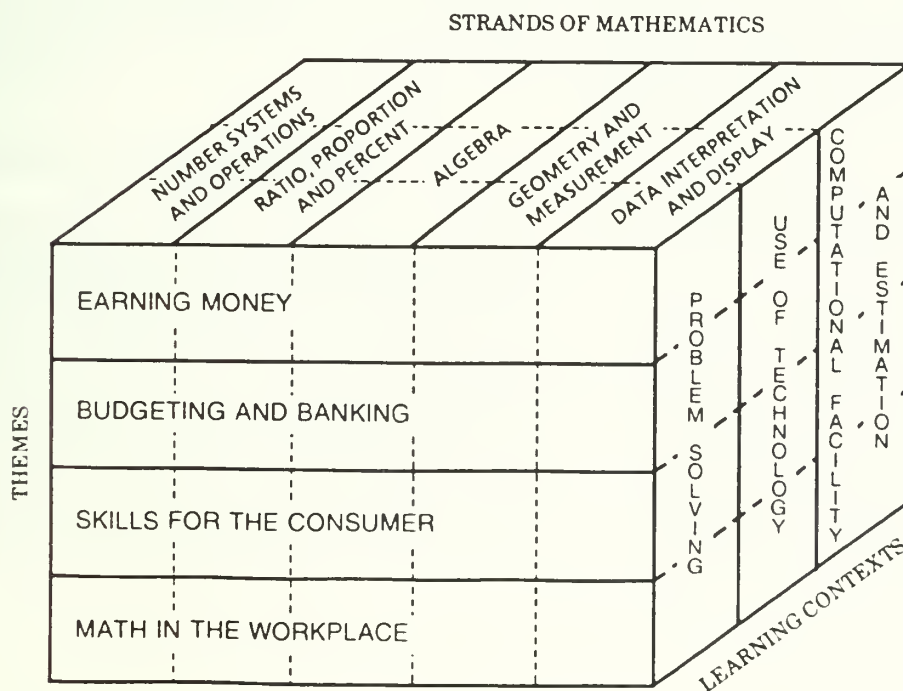
C. STATEMENT OF CONTENT

PROGRAM FRAMEWORK

The framework for the Integrated Occupational Mathematics Program, depicted in the model below, illustrates an integration of program dimensions. Three dimensions that provide a basis for program planning are represented in the model. Prescribed components within the mathematics program are shaded.

- The **STRANDS OF MATHEMATICS**, represented on the upper face of the model, include concepts, skills and attitudes related to five major content areas. Prescribed content within each of the strands has been determined on the basis of frequent task demands placed upon students in everyday life, and represents a consolidation and extension of concepts, skills and attitudes included in the Integrated Occupational Mathematics Program for Grades 8 and 9.
- The **THEMES** provide situational and concrete learning experiences where concepts, skills and attitudes related to each of the strands and learning contexts are linked together in meaningful investigations. The themes are placed on the front face of the model to highlight their importance in planning an integrated program. Four themes that address prescribed components within Mathematics 16 and Mathematics 26 are provided in the *Teacher Resource Manual* (available for each course from the Learning Resources Distributing Centre).
- The **LEARNING CONTEXTS**, represented on the right face of the model, focus attention on strategic behaviours that will enable students to solve problems, use technology and perform computations in daily living. Learning activities that develop these competencies should be provided in concert with activities designed to develop concepts and skills within each of the strands of mathematics.

MODEL FOR THE INTEGRATED OCCUPATIONAL
MATHEMATICS 16-26 PROGRAM



CREDIT ALLOCATION

Mathematics 16 and 26 are each three-credit courses. Schools are encouraged to provide more instructional time than would normally be allocated for a three-credit course if this will help to ensure student success.

COMMUNITY PARTNERSHIPS

Students need to recognize the relevance of computational competence and problem-solving skills in daily life experiences within the home, community and work environments. Within this context, students will be expected to demonstrate competencies that will enable them to:

- apply mathematical concepts and skills to practical situations
- set goals, solve problems and make informed decisions
- prepare for a chosen occupation or career.

Community partnerships (i.e., community-based learning experiences) will foster an appreciation of mathematics for its usefulness and relevance, and will assist students to transfer specific concepts and skills to more generalized situations in everyday life and the world of work. Community partnerships include in-school visits, demonstrations, talks, etc. given by community members; and teacher/student observations, job-shadowing, work study and work experience activities within the community.

CURRICULAR INTEGRATION

Teachers have traditionally tended to integrate knowledge, attitudes and skills from other subject areas into their teaching speciality; however, this tendency has generally been incidental rather than by curricular and instructional design. In contrast, the Integrated Occupational Program is designed specifically to integrate related knowledge, skills and attitudes across the curriculum. In addition, teachers in the program are encouraged to adopt integrated planning and teaching strategies.

Suggestions for relating prescribed content within Mathematics 16 and 26 to daily life skills and applications in other subject areas across the curriculum are provided in the *Program of Studies/Curriculum Guide* and *Teacher Resource Manual* (available for each course from the Learning Resources Distributing Centre).

REQUIRED AND ELECTIVE COMPONENTS

The required component of the Mathematics 16–26 Program includes the concepts, skills and attitudes that all students must acquire. The learner expectations identified within this document comprise the required component of the Mathematics 16–26 course sequence.

The required component of Mathematics 16–26 has been integrated into four themes at each grade level:

- Earning Money
- Budgeting and Banking
- Skills for the Consumer
- Math in the Workplace.

These themes are developed in the *Teacher Resource Manual* (available for each course from the Learning Resources Distributing Centre), and include a variety of student activities intended to provide suggestions, models and strategies. Although using these themes will ensure coverage of the required component, teachers are encouraged to add, delete and alter activities to meet the abilities, needs and interests of students.

The elective component of the Mathematics 16–26 program permits the teacher to:

- extend or expand upon topics, thus embedding additional concepts, skills and attitudes considered appropriate to student interest and need
- enrich the program by introducing new concepts and activities considered relevant to the student and the local community
- remediate or reinforce concepts, skills and attitudes within the required component.

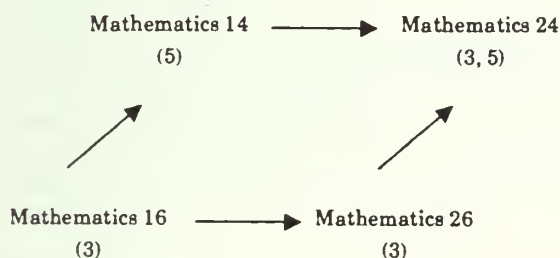
Students' abilities, interests and needs will largely determine how the elective component will be used. Teachers should assess student performance on an ongoing basis, and use the elective component of each course to provide individual students with remedial or enrichment activities.

Instructional time for the Mathematics 16–26 program should be apportioned:

- 80% Required
- 20% Elective.

PROGRAM SEQUENCES AND TRANSFER POINTS

Students must acquire a minimum of three credits in mathematics in order to obtain a Certificate of Achievement. Mathematics 16 will allow students to meet this credit requirement. Mathematics 26 allows students to develop their knowledge and skills in mathematics more fully, and facilitates transfer to the General High School Diploma Program. Program sequences, credits and recommended transfer points are illustrated below.



Students who transfer to the regular program must acquire a minimum of eight credits in mathematics (including Mathematics 24 for at least three credits) in order to obtain a General High School Diploma.

Additional information about transfer routes between the Integrated Occupational Program and the General High School Diploma Program is provided in the *Guide to Education: Senior High School Handbook* (1991-92).

SPECIFIC LEARNER EXPECTATIONS

Specific learner expectations for the Mathematics 16–26 course sequence are provided on the pages that follow. Learner expectations that provide meaningful learning contexts (i.e., problem solving; use of technology; computational facility and estimation) are followed by learner expectations within five strands of mathematics (i.e., number systems and operations; ratio, proportion and percent; algebra; geometry and measurement; data interpretation and display).

Although the specific learner expectations that follow comprise the required component of each mathematics course, they are not intended to provide a sequenced plan for instruction. Prescribed concepts, skills and attitudes should be appropriately clustered and applied to progressively difficult and/or age-appropriate situations as students advance through senior high school. Teachers are encouraged to organize for instruction in ways that are consistent with the abilities, needs and interests of students, using relevant sections of the *Program of Studies/Curriculum Guide* and *Teacher Resource Manual* (available for each course from the Learning Resources Distributing Centre), locally developed themes or a combination of approaches.

Prescribed content for the Mathematics 16–26 course sequence is developmental through Grades 10 and 11. Mathematics 26 provides opportunities for students to reinforce and extend their understanding of content developed in Mathematics 16 through more extensive applications, and prescribes new skills related to each of the five strands of mathematics. In cases where specific learner expectations are repeated in Mathematics 16 and 26, it is expected that teachers will help students to increase in proficiency from grade to grade even though varying levels of proficiency have not been specified.

PROBLEM SOLVING

Problem solving is to be integrated throughout all areas of the mathematics program, as learning to solve problems is a major purpose of studying mathematics. Students should recognize that problems can be solved in many ways, and will be expected to use a variety of strategies that help them to understand problems, develop and carry out a problem-solving plan, and review/apply the results of problem solving.

Concepts, attitudes and skills related to problem solving are listed below. Learning activities that develop these competencies should be provided in concert with activities designed to develop concepts, attitudes and skills within each of the strands of mathematics.

Specific Learner Expectations

Mathematics 16

Attitudes

The student will be encouraged to :

- display a positive attitude toward the application of concepts and skills in mathematics by
 - showing interest and curiosity through willingness to ask questions, share observations and ideas, and seek answers
 - solving mathematical problems and completing assignments independently and in cooperation with others
- appreciate the value of an organized approach to problem solving
- display an attitude of curiosity and openness to new ideas, and be critical and constructive when selecting and applying problem-solving strategies in practical situations
- appreciate the usefulness of problem-solving skills in consumer and work-related situations.

Concepts

The student will be expected to demonstrate an understanding that:

- problems can be routine, requiring only the application of a known procedure/algorithm, or non-routine, requiring the development of a process or the conducting of an investigation
- a variety of strategies/skills are useful in understanding and solving mathematical problems
- computational facility, involving the use of paper-and-pencil algorithms, estimation, mental arithmetic and/or the calculator may assist the problem-solving process.

Mathematics 26

Attitudes

The student will be encouraged to :

- display a positive attitude toward the application of concepts and skills in mathematics by
 - showing interest and curiosity through willingness to ask questions, share observations and ideas, and seek answers
 - solving mathematical problems and completing assignments independently and in cooperation with others
- appreciate the value of an organized approach to problem solving
- display an attitude of curiosity and openness to new ideas, and be critical and constructive when selecting and applying problem-solving strategies in practical situations
- appreciate the usefulness of problem-solving skills in consumer and work-related situations.

Concepts

The student will be expected to demonstrate an understanding that:

- problems can be routine, requiring only the application of a known procedure/algorithm, or non-routine, requiring the development of a process or the conducting of an investigation
- a variety of strategies/skills are useful in understanding and solving mathematical problems
- computational facility, involving the use of paper-and-pencil algorithms, estimation, mental arithmetic and/or the calculator may assist the problem-solving process.

Skills

The student will be expected to demonstrate an ability to:

- apply strategies/skills that are useful in understanding a problem
 - e.g., – reads the problem several times
 - asks questions and refers to other sources to clarify meaning
 - identifies key words and their meanings
 - looks for patterns
 - identifies given and needed information
 - identifies extraneous information
 - internalizes the problem by restating in his or her own words, or by visualizing the problem
 - draws pictures/diagrams
 - uses concrete manipulatives
 - interprets pictures/charts/graphs
 - relates the problem to other problems previously encountered
 - considers alternative interpretations of the problem

- apply strategies/skills that are useful in developing and carrying out a problem-solving plan
 - e.g., – guesses and checks the result (thus improving the guess)
 - uses logic or reason
 - identifies and applies relationships
 - chooses and sequences the operations needed
 - sorts and classifies information
 - applies selected strategies
 - presents ideas clearly
 - selects appropriate calculating/measuring devices and methods
 - acts out or simulates the problem
 - applies patterns
 - estimates the answer
 - documents the process used
 - works carefully

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 - internalizes the problem by restating in his or her own words, or by visualizing the problem
 - draws pictures/diagrams
 - uses concrete manipulatives
 - interprets pictures/charts/graphs
 - relates the problem to other problems previously encountered
 - considers alternative interpretations of the problem
 - determines if there are hidden assumptions that contain information necessary to the solution of the problem

- apply strategies/skills that are useful in developing and carrying out a problem-solving plan
 - e.g., – guesses and checks the result (thus improving the guess)
 - uses logic or reason
 - identifies and applies relationships
 - chooses and sequences the operations needed
 - sorts and classifies information
 - applies selected strategies
 - presents ideas clearly
 - selects appropriate calculating/measuring devices and methods
 - acts out or simulates the problem
 - applies patterns
 - estimates the answer
 - documents the process used
 - works carefully

Mathematics 16

Skills (continued)

- works in a group situation where ideas are shared
- visualizes the problem
- makes positive statements (e.g., "I can solve this.")
- uses a simpler problem (making an analogy)
- identifies factors relevant to the problem
- collects and organizes data into diagrams, charts, tables, pictures, graphs or models
- experiments through the use of manipulatives
- breaks the problem down into smaller parts
- formulates an equation
- recognizes limits and eliminates possibilities

- apply strategies/skills that are useful in reviewing and applying the results of problem solving

- e.g.,
- states an answer to the problem
 - restates the problem with an answer
 - explains the answer in oral/written form
 - determines if the answer is reasonable
 - discusses with others the process used
 - suggests other ways of solving the problem
 - checks the answer
 - considers the possibility of other answers/solutions
 - makes and solves similar problems
 - generalizes the solutions and applies the process used to other situations.

Mathematics 26

Skills (continued)

- works in a group situation where ideas are shared
- visualizes the problem
- makes positive statements (e.g., "I can solve this.")
- uses a simpler problem (making an analogy)
- identifies factors relevant to the problem
- collects and organizes data into diagrams, charts, tables, pictures, graphs or models
- experiments through the use of manipulatives
- breaks the problem down into smaller parts
- formulates an equation
- recognizes limits and eliminates possibilities
- constructs flow charts
- works backward through the problem
- examines the problem from varying perspectives/points of view

- apply strategies/skills that are useful in reviewing and applying the results of problem solving

- e.g.,
- states an answer to the problem
 - restates the problem with an answer
 - explains the answer in oral/written form
 - determines if the answer is reasonable
 - discusses with others the process used
 - suggests other ways of solving the problem
 - checks the answer
 - considers the possibility of other answers/solutions
 - makes and solves similar problems
 - generalizes the solutions and applies the process used to other situations
 - creates other routine/non-routine problems that require the use of a similar process.

USE OF TECHNOLOGY

Students will be expected to develop an understanding of the pervasiveness of technology, its advantages and limitations in society, and strategies for harnessing its potential in productive ways. All students shall have appropriate calculators available for use throughout the program, and will be expected to become proficient and discerning in their use. To the extent that computer facilities and equipment are available, students will be expected to work independently with prepared software, and use simple programs that have been written for particular purposes.

Concepts, attitudes and skills related to the use of technology are listed below. Learning activities that develop these competencies should be provided in concert with activities designed to develop concepts, attitudes and skills within each of the strands of mathematics.

Specific Learner Expectations

Mathematics 16

Attitudes

The student will be encouraged to :

- demonstrate confidence in ability to use a calculator effectively in problem-solving situations that require quantitative thinking and computational facility
- appreciate current and potential impacts of computer technology in everyday and work-related situations.

Concepts

The student will be expected to demonstrate an understanding that:

- calculators and computers have influenced the nature of the computational procedures and problem-solving processes that we use
- computer technologies have basic capabilities and limitations that determine the nature of the tasks they perform
- effective use of calculators and computers requires knowledge of appropriate procedures for their use.

Skills

The student will be expected to demonstrate an ability to:

- identify appropriate and inappropriate uses of the calculator
- clear the display of the calculator and correct entry errors

Mathematics 26

Attitudes

The student will be encouraged to :

- demonstrate confidence in ability to use a calculator effectively in problem-solving situations that require quantitative thinking and computational facility
- appreciate current and potential impacts of computer technology in everyday and work-related situations.

Concepts

The student will be expected to demonstrate an understanding that:

- calculators and computers have influenced the nature of the computational procedures and problem-solving processes that we use
- computer technologies have basic capabilities and limitations that determine the nature of the tasks they perform
- effective use of calculators and computers requires knowledge of appropriate procedures for their use.

Skills

The student will be expected to demonstrate an ability to:

- identify appropriate and inappropriate uses of the calculator
- clear the display of the calculator and correct entry errors

Mathematics 16

Skills (continued)

- use the calculator to perform computations with whole numbers, decimals, fractions, integers and percent
 - identifies and uses basic functions (i.e., +, −, ÷, ×, %, =, decimal, clear)
 - enters numbers in correct sequence for subtraction and division
 - determines whole number remainders for division
 - uses subtotals and memory for adding, subtracting, multiplying and dividing
 - converts fractions to decimal and percent form
 - generates sets of multiples for a given number
 - follows order of operations
- select from calculator display the number of decimal places appropriate to the context of a calculation/problem
- use estimation and mental arithmetic to check the reasonableness of answers obtained on the calculator
- identify major parts of a computer
- distinguish between hardware and software
- explain how computers get their instructions from a program written to accomplish a specific task
- give examples of the applications of computers in performing tasks that require speed, accuracy, repeated operations and the processing of large amounts of data
- identify major areas in society where computers are used and the tasks performed by computers in these areas
- give examples of tasks that computers cannot accomplish.

Mathematics 26

Skills (continued)

- use the calculator to perform computations with whole numbers, decimals, fractions, integers and percent
 - identifies and uses basic functions (i.e., +, −, ÷, ×, %, =, decimal, clear)
 - enters numbers in correct sequence for subtraction and division
 - determines whole number remainders for division
 - uses subtotals and memory for adding, subtracting, multiplying and dividing
 - converts fractions to decimal and percent form
 - generates sets of multiples for a given number
 - follows order of operations
- select from calculator display the number of decimal places appropriate to the context of a calculation/problem
- use estimation and mental arithmetic to check the reasonableness of answers obtained on the calculator
- identify and use additional functions on the calculator (i.e., x^2 , y^x , $\sqrt{}$)
- identify major parts of a computer
- distinguish between hardware and software
- explain how computers get their instructions from a program written to accomplish a specific task
- give examples of the applications of computers in performing tasks that require speed, accuracy, repeated operations and the processing of large amounts of data
- identify major areas in society where computers are used and the tasks performed by computers in these areas
- give examples of tasks that computers cannot accomplish.

COMPUTATIONAL FACILITY AND ESTIMATION

Students will be expected to develop an understanding that there are several ways to perform numerical computations, and that the method chosen will depend upon the situation at hand. All students will develop strategies for performing computations through the use of mental arithmetic, paper and pencil, the calculator and estimation. Students will also be expected to discern when each method is most appropriately used in everyday problem-solving situations, and to determine whether or not answers are reasonable.

Concepts, attitudes and skills related to computational facility and estimation are listed below. Learning activities that develop these competencies should be provided throughout the mathematics program within the context of real life and work-related situations, and in concert with activities designed to develop concepts, attitudes and skills within each of the strands of mathematics.

Specific Learner Expectations

Mathematics 16

Attitudes

The student will be encouraged to :

- demonstrate flexibility and ingenuity when selecting and applying appropriate methods of computation in daily life and work-related situations
- appreciate the usefulness of computational facility and estimation in solving everyday problems and making informed decisions.

Concepts

The student will be expected to demonstrate an understanding that:

- computation can be performed by a variety of methods, and may include the use of mental arithmetic, paper-and-pencil algorithms, estimation and the calculator
- one must consider the degree of precision/accuracy that is required when selecting a method of computation that is appropriate to a particular problem situation
- checking an answer for its reasonableness and accuracy is a fundamental step in the computational process
- estimation is useful in determining the reasonableness of the results of computation and problem solving.

Mathematics 26

Attitudes

The student will be encouraged to :

- demonstrate flexibility and ingenuity when selecting and applying appropriate methods of computation in daily life and work-related situations
- appreciate the usefulness of computational facility and estimation in solving everyday problems and making informed decisions.

Concepts

The student will be expected to demonstrate an understanding that:

- computation can be performed by a variety of methods, and may include the use of mental arithmetic, paper-and-pencil algorithms, estimation and the calculator
- one must consider the degree of precision/accuracy that is required when selecting a method of computation that is appropriate to a particular problem situation
- checking an answer for its reasonableness and accuracy is a fundamental step in the computational process
- estimation is useful in determining the reasonableness of the results of computation and problem solving.

Skills

The student will be expected to demonstrate an ability to:

- use mental arithmetic skills that are based upon
 - all single-digit operations
 - sequences of operations
 - doubling and halving
 - multiplying and dividing by powers of 10
 - applications of the commutative, associative and distributive properties
 - properties of zero and one
 - strategies appropriate to the situation (e.g., compensation, computing from left to right)
- use paper-and-pencil algorithms to perform computations with whole numbers, decimals, fractions, integers and percent within parameters established for the program (see Number Systems and Operations; Ratio, Proportion and Percent)
- use the calculator to perform computations with whole numbers, decimals, fractions, integers and percent within parameters established by the nature of the problem (see Use of Technology)
- use estimation skills that are based upon
 - stating the largest and smallest reasonable answer to a problem before solving the problem
 - predicting whether a computation will result in a larger or smaller number
 - forecasting an order of magnitude for the result of a computation (e.g., 10's, 100's, 1000's)
 - predicting the magnitude of the result of a computation through use of strategies appropriate to the situation (e.g., front-end estimation, rounding, clustering, compatible numbers).

Skills

The student will be expected to demonstrate an ability to:

- use mental arithmetic skills that are based upon
 - all single-digit operations
 - sequences of operations
 - doubling and halving
 - multiplying and dividing by powers of 10
 - applications of the commutative, associative and distributive properties
 - properties of zero and one
 - strategies appropriate to the situation (e.g., compensation, computing from left to right)
- use paper-and-pencil algorithms to perform computations with whole numbers, decimals, fractions, integers and percent within parameters established for the program (see Number Systems and Operations; Ratio, Proportion and Percent)
- use the calculator to perform computations with whole numbers, decimals, fractions, integers and percent within parameters established by the nature of the problem (see Use of Technology)
- use estimation skills that are based upon
 - stating the largest and smallest reasonable answer to a problem before solving the problem
 - predicting whether a computation will result in a larger or smaller number
 - forecasting an order of magnitude for the result of a computation (e.g., 10's, 100's, 1000's)
 - predicting the magnitude of the result of a computation through use of strategies appropriate to the situation (e.g., front-end estimation, rounding, clustering, compatible numbers).

NUMBER SYSTEMS AND OPERATIONS

Students will be expected to demonstrate knowledge of the basic properties of whole numbers, decimals, fractions and integers, and of appropriate strategies for performing operations with these numbers. Instructional activities should provide opportunities for students to build concepts and demonstrate understandings through the use of concrete models and materials.

Concepts, attitudes and skills within this strand of mathematics are listed below. Learning activities that develop these competencies should be provided throughout the mathematics program within the context of real life and work-related situations, rather than as a topic on their own.

Specific Learner Expectations

Mathematics 16

Attitudes

The student will be encouraged to :

- appreciate the usefulness of whole numbers, decimals, fractions and integers in practical everyday activities and work-related situations
- display an attitude of curiosity and openness to new ideas, and be critical and constructive when selecting and applying computational procedures in problem-solving situations.

Concepts

The student will be expected to demonstrate an understanding that:

- effective use of whole numbers, decimals, fractions and integers requires knowledge of appropriate notation and number properties
- performing operations of addition, subtraction, multiplication and division with whole numbers, decimals, fractions and integers involves the application of certain processes
- checking an answer for reasonableness and accuracy is a fundamental step in performing operations with number systems
- computation with whole numbers, decimals, fractions and integers may involve the use of paper-and-pencil algorithms, estimation, mental arithmetic and/or the calculator.

Skills

Whole Numbers

The student will be expected to demonstrate an ability to:

- identify place value to one million
- read numbers to one million in context
- write numbers in numeric or word form to one million
- quantify and order numbers to one million
- identify even and odd numbers
- round numbers to nearest 10, 100, 1000, 10 000 and 100 000
- interpret/use numerical terms (i.e., pair, triplet, decade, dozen, century)
- add and subtract whole numbers (limit for paper-and-pencil computation: numbers less than 10 000)

Mathematics 26

Attitudes

The student will be encouraged to :

- appreciate the usefulness of whole numbers, decimals, fractions and integers in practical everyday activities and work-related situations
- display an attitude of curiosity and openness to new ideas, and be critical and constructive when selecting and applying computational procedures in problem-solving situations.

Concepts

The student will be expected to demonstrate an understanding that:

- effective use of whole numbers, decimals, fractions and integers requires knowledge of appropriate notation and number properties
- performing operations of addition, subtraction, multiplication and division with whole numbers, decimals, fractions and integers involves the application of certain processes
- checking an answer for reasonableness and accuracy is a fundamental step in performing operations with number systems
- computation with whole numbers, decimals, fractions and integers may involve the use of paper-and-pencil algorithms, estimation, mental arithmetic and/or the calculator.

Skills

Whole Numbers

The student will be expected to demonstrate an ability to:

- identify place value to one million
- read numbers to one million in context
- write numbers in numeric or word form to one million
- quantify and order numbers to one million
- identify even and odd numbers
- round numbers to nearest 10, 100, 1000, 10 000 and 100 000
- interpret/use numerical terms (i.e., pair, triplet, decade, dozen, century)
- add and subtract whole numbers (limit for paper-and-pencil computation: numbers less than 10 000)

Mathematics 16

Skills (continued)

- use mental arithmetic to determine products when multiplying by multiples of ten
- multiply whole numbers (limit for paper-and-pencil computation: numbers less than 10 000 by numbers less than 100)
- apply divisibility rules for 2, 3, 5 and 10
- divide whole numbers (limit for paper-and-pencil computation: numbers less than 10 000 by numbers less than 100)
- determine the lowest common multiple for pairs of numbers less than 10
- express numbers up to 50 as the product of prime factors
- determine the greatest common factor for pairs of numbers less than 50.

Decimals

The student will be expected to demonstrate an ability to:

- identify place value to thousandths
- read decimals to thousandths in context
- write decimals in numeric form to thousandths
- quantify and order numbers to three decimal places in applications
- round decimals to the nearest whole number, tenth and hundredth
- add and subtract decimals (limit for paper-and-pencil computation: numbers to thousandths)
- multiply decimals (limit for paper-and-pencil computation: numbers that yield products to thousandths, using one- or two-digit multipliers)
- divide decimals (limit for paper-and-pencil computation: numbers having five digits or less by one- or two-digit divisors; dividend may have 0, 1, 2 or 3 decimal places, divisor may be a whole number or decimal)

Mathematics 26

Skills (continued)

- use mental arithmetic to determine products when multiplying by multiples of ten
- multiply whole numbers (limit for paper-and-pencil computation: numbers less than 10 000 by numbers less than 100)
- apply divisibility rules for 2, 3, 5 and 10
- divide whole numbers (limit for paper-and-pencil computation: numbers less than 10 000 by numbers less than 100)
- determine the lowest common multiple for pairs of numbers less than 10
- express numbers up to 50 as the product of prime factors
- determine the greatest common factor for pairs of numbers less than 50
- describe the meaning of terms related to the use of exponents (i.e., exponent, base, power, "squared", "cubed")
- determine the value of a power, using whole number base and exponents of 2 and 3
- determine the square root of whole numbers, using estimation/square root tables/calculator.

Decimals

The student will be expected to demonstrate an ability to:

- identify place value to thousandths
- read decimals to thousandths in context
- write decimals in numeric form to thousandths
- quantify and order numbers to three decimal places in applications
- round decimals to the nearest whole number, tenth and hundredth
- add and subtract decimals (limit for paper-and-pencil computation: numbers to thousandths)
- multiply decimals (limit for paper-and-pencil computation: numbers that yield products to thousandths, using one- or two-digit multipliers)
- divide decimals (limit for paper-and-pencil computation: numbers having five digits or less by one- or two-digit divisors; dividend may have 0, 1, 2 or 3 decimal places, divisor may be a whole number or decimal)

Mathematics 16

Skills (continued)

- use mental arithmetic to determine products/quotients when multiplying/dividing by multiples of 10.

Fractions

The student will be expected to demonstrate an ability to:

- illustrate a fraction as part of a whole, part of a set, or a point on a number line
- describe proper/improper fractions and mixed numbers through the use of objects, pictures and diagrams
- use a number line to illustrate the relationship between whole numbers, decimals and fractions
- compare and order fractions in applications
- identify and determine equivalent fractions (including proper and improper fractions, mixed numbers)
- identify and express fractions in basic form
- convert proper/improper/mixed fractions to decimals using a calculator
- recall decimal equivalents for one-half, thirds, quarters, fifths and tenths
- determine common denominators for fractions having denominators of 2, 3, 4, 5, 8, 10 and 16
- add/subtract fractions and mixed numbers having like/unlike denominators that are within the parameters stated above
- multiply/divide proper fractions and mixed numbers by whole numbers
- calculate a fractional part of an amount in applications.

Mathematics 26

Skills (continued)

- use mental arithmetic to determine products/quotients when multiplying/dividing by multiples of 10
- recognize place value beyond the thousandths place in work-related situations (e.g., reading the micrometer)
- round to the nearest thousandth/ten thousandth as required in work-related situations.

Fractions

The student will be expected to demonstrate an ability to:

- illustrate a fraction as part of a whole, part of a set, or a point on a number line
- describe proper/improper fractions and mixed numbers through the use of objects, pictures and diagrams
- use a number line to illustrate the relationship between whole numbers, decimals and fractions
- compare and order fractions in applications
- identify and determine equivalent fractions (including proper and improper fractions, mixed numbers)
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- recall decimal equivalents for one-half, thirds, quarters, fifths and tenths
- determine common denominators for fractions having denominators of 2, 3, 4, 5, 8, 10 and 16
- add/subtract fractions and mixed numbers having like/unlike denominators that are within the parameters stated above
- multiply/divide proper fractions and mixed numbers by whole numbers
- calculate a fractional part of an amount in applications
- multiply/divide proper fractions and mixed numbers by whole numbers/proper fractions.

Mathematics 16

Skills (continued)

Integers

The student will be expected to demonstrate an ability to:

- identify situations that require the use of integers
- use vocabulary related to integers (i.e., positive, negative, plus, minus, above, below, gain, loss)
- place integers on the number line
- compare and order integers in practical applications
- add pairs/groups of one- and two-digit integers.

Mathematics 26

Skills (continued)

Integers

The student will be expected to demonstrate an ability to:

- identify situations that require the use of integers
- use vocabulary related to integers (i.e., positive, negative, plus, minus, above, below, gain, loss)
- place integers on the number line
- compare and order integers in practical applications
- add pairs/groups of one- and two-digit integers
- add/subtract pairs of integers containing three digits or less
- multiply/divide pairs of one- and two-digit integers (where multiplier and divisor are positive)
- describe the use of integers in locating points on the coordinate plane.

RATIO, PROPORTION AND PERCENT

Students will be expected to demonstrate an understanding of ratio, proportion and percent, and use related concepts and skills in evaluating media claims and making informed decisions in buying, selling or investing. Instruction at the intuitive and concrete level will assist students to internalize concepts and apply skills in real-life situations.

Concepts, attitudes and skills related to ratio, proportion and percent are listed below. Learning activities that develop these competencies should be provided throughout the mathematics program in concert with activities designed to develop concepts, attitudes and skills within other strands of the mathematics program.

Specific Learner Expectations

Mathematics 16

Attitudes

The student will be encouraged to :

- appreciate the usefulness of ratio, proportion and percent skills in solving consumer problems
- appreciate the importance of computational facility and critical thinking skills in evaluating information and making informed decisions in daily life and work-related situations.

Mathematics 26

Attitudes

The student will be encouraged to :

- appreciate the usefulness of ratio, proportion and percent skills in solving consumer problems
- appreciate the importance of computational facility and critical thinking skills in evaluating information and making informed decisions in daily life and work-related situations.

Concepts

The student will be expected to demonstrate an understanding that:

- a ratio is a comparison of the relative sizes of two quantities
- a rate is a ratio between quantities that have different units
- proportions are statements about equivalent ratios
- percent is a ratio in which a quantity is compared to 100.

Skills

The student will be expected to demonstrate an ability to:

- compare two quantities in the same unit by writing ratios in the form a/b , $a:b$ and a to b
- generate equivalent ratios
- calculate rates/unit rates by writing ratios that involve numbers with different units (e.g., 90 km/2h, 3 items for \$1.00)
- identify proportions as statements about equivalent ratios
- write proportions that describe practical problem situations
- calculate the unknown value in a proportion
- express whole number percents as ratios/decimals
- express ratios as decimals and percents
(i.e., $\frac{a}{b} = \frac{?}{100}$ where $b=2, 4, 5, 10, 20, 25$ or 50)
- recall fraction, decimal and percent equivalents for one-half, quarters and tenths
- express one-, two- and three-place decimals as percents
- determine other fraction, decimal and percent equivalents through the use of the calculator
- calculate/estimate a percent of a number.

Concepts

The student will be expected to demonstrate an understanding that:

- a ratio is a comparison of the relative sizes of two quantities
- a rate is a ratio between quantities that have different units
- proportions are statements about equivalent ratios
- percent is a ratio in which a quantity is compared to 100.

Skills

The student will be expected to demonstrate an ability to:

- compare two quantities in the same unit by writing ratios in the form a/b , $a:b$ and a to b
- generate equivalent ratios
- calculate rates/unit rates by writing ratios that involve numbers with different units (e.g., 90 km/2h, 3 items for \$1.00)
- identify proportions as statements about equivalent ratios
- write proportions that describe practical problem situations
- calculate the unknown value in a proportion
- express whole number percents as ratios/decimals
- using a calculator, convert fractional percents to fraction and decimal forms (e.g., $12\frac{1}{2}\% = \frac{1}{8} = 0.125$)
- express ratios as decimals and percents
(i.e., $\frac{a}{b} = \frac{?}{100}$ where $b=2, 4, 5, 10, 20, 25$ or 50)
- recall fraction, decimal and percent equivalents for one-half, quarters and tenths
- express one-, two- and three-place decimals as percents
- determine other fraction, decimal and percent equivalents through the use of the calculator
- calculate/estimate a percent of a number
- calculate/estimate what percent one number is of another
- calculate/estimate any one of the missing elements in practical problems involving application of percent (i.e., determines percentage, rate or base).

ALGEBRA

This strand will focus attention on the use of patterns, relationships and logical thinking skills to make predictions and solve problems. Students will be expected to generalize arithmetical patterns and relationships that are present in concrete situations, and write expressions/equations that describe the patterns and relationships they discover. Students will also develop substitution and equation-solving skills, and apply these skills in solving practical problems.

Concepts, attitudes and skills within this strand are listed below. Learning activities that develop these competencies should be provided within the context of real life and work-related situations, and in concert with activities designed to develop concepts, attitudes and skills within other strands of the mathematics program.

Specific Learner Expectations

Mathematics 16

Attitudes

The student will be encouraged to :

- demonstrate an awareness of number patterns and relationships that are present in practical situations, and the usefulness of algebra in describing these relationships
- appreciate the utility of algebra skills in making predictions and solving problems in daily life and work-related situations.

Concepts

The student will be expected to demonstrate an understanding that:

- arithmetical patterns and relationships are present in a variety of practical everyday situations, and are useful in enabling us to draw conclusions and make predictions
- algebraic symbols can be used to write expressions/formulas/linear equations that describe familiar arithmetical patterns and relationships
- substitution and equation-solving strategies are useful in solving practical problems, and involve application of number properties and operations.

Skills

The student will be expected to demonstrate an ability to:

- distinguish between the use of variables and constants in practical situations
- use variables to write mathematical expressions/equations that describe familiar situations
- evaluate expressions for given whole number values of the variable

Mathematics 26

Attitudes

The student will be encouraged to :

- demonstrate an awareness of number patterns and relationships that are present in practical situations, and the usefulness of algebra in describing these relationships
- appreciate the utility of algebra skills in making predictions and solving problems in daily life and work-related situations.

Concepts

The student will be expected to demonstrate an understanding that:

- arithmetical patterns and relationships are present in a variety of practical everyday situations, and are useful in enabling us to draw conclusions and make predictions
- algebraic symbols can be used to write expressions/formulas/linear equations that describe familiar arithmetical patterns and relationships
- substitution and equation-solving strategies are useful in solving practical problems, and involve application of number properties and operations.

Skills

The student will be expected to demonstrate an ability to:

- distinguish between the use of variables and constants in practical situations
- use variables to write mathematical expressions/equations that describe familiar situations
- evaluate expressions for given whole number values of the variable

Mathematics 16

Mathematics 26

Skills (continued)

- use estimation, guess/check, concrete manipulatives and formal strategies to find whole number solutions for simple equations (e.g., $x \pm a = b$, $ax = b$, $x/a = b/c$, $ax \pm b = c$)
- apply equation-solving skills to practical problem situations
- interpret formulas as word statements
- use formulas and substitution to solve problems in practical situations (e.g., if $P = 2L + 2W$, find P when $L = 10$ and $W = 8$).

Skills (continued)

- use estimation, guess/check, concrete manipulatives and formal strategies to find decimal solutions for simple equations (e.g., $x \pm a = b$, $ax = b$, $x/a = b/c$, $ax \pm b = c$)
- apply equation-solving strategies/skills to practical situations involving decimals
- use substitution and equation-solving strategies to find the missing element in a formula (e.g., if $P = 2L + 2W$, find L when $P = 16$ and $W = 3$).

GEOMETRY AND MEASUREMENT

This strand will focus attention on developing spatial and visualization skills, and an understanding of how measures are used to quantify and interpret the world. Students will be expected to demonstrate an understanding of the attribute/properties of familiar one-, two- and three-dimensional geometric figures, and to apply related patterns/relationships in solving practical problems. Students will also be expected to estimate and measure length, area, volume, capacity, mass, time, temperature and angles in order to solve problems and make predictions.

It is the policy of Alberta Education that SI units be the principal system of measurement in the curriculum of the schools in the province. The study of specific Imperial units should be related only to those that are relevant to student needs (as indicated by the demands of the workplace/community partnership sites) and should be kept to a minimum.

Concepts, attitudes and skills within this strand are listed below. Learning activities that develop these competencies should be provided within the context of real life and work-related situations, and should reflect a "doing" kind of mathematics where relevant activity gives meaning to skills that are being developed.

Specific Learner Expectations

Mathematics 16

Attitudes

The student will be encouraged to :

- appreciate how geometry and measurement provide us with methods for gathering and organizing information about the physical world
- appreciate the ways in which geometry and measurement affect our daily activities and contribute to the problem-solving process.

Concepts

The student will be expected to demonstrate an understanding that:

- geometry is a visual approach to organizing and interpreting our perceptions of the environment and physical world
- there are basic concepts, patterns and relationships associated with one-, two- and three-dimensional geometric figures

Mathematics 26

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- appreciate how geometry and measurement provide us with methods for gathering and organizing information about the physical world
- appreciate the ways in which geometry and measurement affect our daily activities and contribute to the problem-solving process.

Concepts

The student will be expected to demonstrate an understanding that:

- geometry is a visual approach to organizing and interpreting our perceptions of the environment and physical world
- there are basic concepts, patterns and relationships associated with one-, two- and three-dimensional geometric figures

Mathematics 16

Concepts (continued)

- the selection of units and tools of measurement must always be based upon the physical attributes of the object being measured
- estimation and measurement are iterative and comparative in nature
- a mental frame of reference is useful in establishing the size of standard units of measure, relative to each other and to real objects
- geometry and measurement contribute to the problem-solving process, and have application in activities we engage in as citizen, consumer and worker.

Skills

Geometry

The student will be expected to demonstrate an ability to:

- identify line relationships (i.e., horizontal, vertical, parallel, perpendicular and intersecting)
- identify/construct basic two-dimensional geometric figures (i.e., rectangle, square, parallelogram, triangle)
- classify triangles and quadrilaterals by examining measures of sides and measures of angles
- identify the relationship between the radius and diameter of a circle
- construct circles, given either radius or diameter
- identify similar and congruent geometric figures
- identify/sketch/construct models of basic three-dimensional shapes (i.e., rectangular solid, cube, cylinder, cone)
- construct geometric figures/designs, using a variety of construction tools (i.e., straightedge, ruler, compass, protractor, computer).

Mathematics 26

Concepts (continued)

- the selection of units and tools of measurement must always be based upon the physical attributes of the object being measured
- estimation and measurement are iterative and comparative in nature
- a mental frame of reference is useful in establishing the size of standard units of measure, relative to each other and to real objects
- geometry and measurement contribute to the problem-solving process, and have application in activities we engage in as citizen, consumer and worker.

Skills

Geometry

The student will be expected to demonstrate an ability to:

- identify line relationships (i.e., horizontal, vertical, parallel, perpendicular and intersecting)
- identify/construct basic two-dimensional geometric figures (i.e., rectangle, square, parallelogram, triangle)
- classify triangles and quadrilaterals by examining measures of sides and measures of angles
- identify/classify polygons according to the number of sides
- constructs regular polygons (i.e., triangle, square, hexagon, octagon)
- identify the relationship between the radius and diameter of a circle
- construct circles, given either radius or diameter
- identify similar and congruent geometric figures
- identify/sketch/construct models of basic three-dimensional shapes (i.e., rectangular solid, cube, cylinder, cone)
- construct geometric figures/designs, using a variety of construction tools (i.e., straightedge, ruler, compass, protractor, computer)
- describe the terminology associated with the coordinate system (i.e., origin, axis, quadrant, coordinates, ordered pair)
- plot a point on the coordinate plane when given its coordinates, and identify the coordinates for a point graphed in the coordinate plane.

Mathematics 16

Skills (continued)

Length

The student will be expected to demonstrate an ability to:

- identify common SI units of length (i.e., mm, cm, m, km)
- estimate/measure length, using metric units and tools appropriate to the situation
- convert among SI units of length as required in applications
- estimate/measure/calculate the perimeter of figures bounded by line segments using units and tools appropriate to the situation
- identify the value of π as the ratio of the circumference of a circle to its diameter
- develop/apply strategies for determining the circumference of a circle.

Area

The student will be expected to demonstrate an ability to:

- identify common SI units of area (i.e., cm^2 , m^2) and their application in practical situations
- approximate the area of two-dimensional geometric figures using a square grid
- estimate/calculate area of the rectangle, square, triangle and circle, using units, tools and strategies appropriate to the situation.

Volume

The student will be expected to demonstrate an ability to:

- identify common SI units of volume (i.e., cm^3 , m^3) and their application in practical situations
- approximate the volume of rectangular solids using cubes
- estimate/calculate the volume of rectangular solids and cubes, using units, tools and strategies appropriate to the situation.

Mathematics 26

Skills (continued)

Length

The student will be expected to demonstrate an ability to:

- identify common SI units of length (i.e., mm, cm, m, km)
- estimate/measure length, using metric units and tools appropriate to the situation
- convert among SI units of length as required in applications
- estimate/measure/calculate the perimeter of figures bounded by line segments using units and tools appropriate to the situation
- develop/apply strategies for determining the perimeter of any regular polygon
- identify the value of π as the ratio of the circumference of a circle to its diameter
- develop/apply strategies for determining the circumference of a circle
- describe the Pythagorean relationship among sides of a right triangle, and apply the relationship to practical situations.

Area

The student will be expected to demonstrate an ability to:

- identify common SI units of area (i.e., cm^2 , m^2) and their application in practical situations
- approximate the area of two-dimensional geometric figures using a square grid
- estimate/calculate area of the rectangle, square, triangle and circle, using units, tools and strategies appropriate to the situation
- develop/apply appropriate strategies for determining the surface area of rectangular solids and cylinders.

Volume

The student will be expected to demonstrate an ability to:

- identify common SI units of volume (i.e., cm^3 , m^3) and their application in practical situations
- approximate the volume of rectangular solids using cubes
- estimate/calculate the volume of rectangular solids and cubes, using units, tools and strategies appropriate to the situation
- identify the equivalence between cubic centimetres and millilitres
- develop/apply appropriate strategies for determining the volume of right cylinders.

Mathematics 16

Skills (continued)

Capacity

The student will be expected to demonstrate an ability to:

- identify common SI units of capacity (i.e., mL, L) and their application in practical situations
- estimate and measure capacity, using metric units and tools appropriate to the situation
- convert between mL and L.

Mass

The student will be expected to demonstrate an ability to:

- identify common SI units of mass (i.e., g, kg, t) and their application in practical situations
- estimate and measure mass, using metric units and tools appropriate to the situation
- convert between g and kg, and between kg and t.

Time

The student will be expected to demonstrate an ability to:

- use a calendar, recognizing the relationship between days, weeks, months and years
- use accepted standards for numeric dating
- estimate/measure/record time on the 12-hour and 24-hour clocks, using traditional and digital time pieces
- determine the interval between a pair of times
- determine the finishing time, given the starting time and duration.

Mathematics 26

Skills (continued)

Capacity

The student will be expected to demonstrate an ability to:

- identify common SI units of capacity (i.e., mL, L) and their application in practical situations
- estimate and measure capacity, using metric units and tools appropriate to the situation
- convert between mL and L.

Mass

The student will be expected to demonstrate an ability to:

- identify common SI units of mass (i.e., g, kg, t) and their application in practical situations
- estimate and measure mass, using metric units and tools appropriate to the situation
- convert between g and kg, and between kg and t.

Time

The student will be expected to demonstrate an ability to:

- use a calendar, recognizing the relationship between days, weeks, months and years
- use accepted standards for numeric dating
- estimate/measure/record time on the 12-hour and 24-hour clocks, using traditional and digital time pieces
- determine the interval between a pair of times
- determine the finishing time, given the starting time and duration.

Temperature

The student will be expected to demonstrate an ability to:

- estimate/measure temperature on the Celsius scale
- recall important temperatures on the Celsius scale (i.e., boiling/freezing point of water, normal room/body temperature)
- determine temperature change, including changes from below zero to above zero and vice versa.

Mathematics 16

Skills (continued)

Angle

The student will be expected to demonstrate an ability to:

- identify an angle and the degree as a unit of measure
- identify/estimate angles of 30° , 45° , 60° , 90° , 180° and 360°
- use a protractor to measure and draw angles from 0° to 180° .

Mathematics 26

Skills (continued)

Angle

The student will be expected to demonstrate an ability to:

- identify an angle and the degree as a unit of measure
- identify/estimate angles of 30° , 45° , 60° , 90° , 180° and 360°
- use a protractor to measure and draw angles from 0° to 360°
- apply knowledge of the sum of the angles of a triangle in practical situations.

DATA INTERPRETATION AND DISPLAY

Students will be expected to demonstrate an understanding that numerical data collected from a sample must be organized, displayed and analyzed in order that valid inferences can be drawn. Students will develop strategies for collecting, organizing, displaying and interpreting numerical data in a variety of practical situations, and for predicting probable outcomes based on data that has been collected. As students perform related experiments, they will develop ability to think consistently about arguments, justify their thinking with numerical information, and cope with uncertainty.

Concepts, attitudes and skills within this strand are listed below. Learning activities that develop these competencies should be provided within the context of real life and work-related situations, and in concert with activities designed to develop concepts, attitudes and skills within other strands of the mathematics program.

Specific Learner Expectations

Mathematics 16

Attitudes

The student will be encouraged to:

- appreciate the need to interpret and evaluate statistical data provided through the media
- appreciate how statistics and probability may assist the decision-making process in consumer and work-related situations.

Concepts

The student will be expected to demonstrate an understanding that:

- throughout life, many decisions are based on numerical data
- a variety of procedures can be used to collect, organize and display numerical data

Mathematics 26

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Concepts

The student will be expected to demonstrate an understanding that:

- throughout life, many decisions are based on numerical data
- a variety of procedures can be used to collect, organize and display numerical data

Mathematics 16

Concepts (continued)

- data collected from a sample must be organized, displayed and analyzed in order that valid inferences can be drawn and predictions made
- probability provides a way to measure uncertainty
- statistical measures are useful in summarizing large quantities of numerical data, in communicating ideas and in predicting future outcomes of actions.

Skills

The student will be expected to demonstrate an ability to :

- distinguish between a survey and census, also between a sample and population, identifying potential biases that may occur in surveys and samples
- interpret and analyze data presented in tables/charts and bar/line/picture/circle graphs
- display data in the form of tables/charts and bar/line/picture/circle graphs
- identify the characteristics of a misleading graphical display
- determine/calculate appropriate measures of central tendency in practical situations (i.e., mean, median, mode, range)
- conduct a survey or poll, using appropriate methods of gathering, organizing, presenting and analyzing data:
 - select a suitable sample from a given population
 - collect and organize data using tally sheets/frequency tables
 - display data in the form of bar/line/picture/ circle graphs
 - make inferences/generalizations about the population from which a sample was taken.

Mathematics 26

Concepts (continued)

- data collected from a sample must be organized, displayed and analyzed in order that valid inferences can be drawn and predictions made
- probability provides a way to measure uncertainty
- statistical measures are useful in summarizing large quantities of numerical data, in communicating ideas and in predicting future outcomes of actions.

Skills

The student will be expected to demonstrate an ability to :

- distinguish between a survey and census, also between a sample and population, identifying potential biases that may occur in surveys and samples
- interpret and analyze data presented in tables/charts and bar/line/picture/circle graphs
- display data in the form of tables/charts and bar/line/picture/circle graphs
- identify the characteristics of a misleading graphical display
- determine/calculate appropriate measures of central tendency in practical situations (i.e., mean, median, mode, range)
- conduct a survey or poll, using appropriate methods of gathering, organizing, presenting and analyzing data:
 - select a suitable sample from a given population
 - collect and organize data using tally sheets/frequency tables
 - display data in the form of bar/line/picture/ circle graphs
 - make inferences/generalizations about the population from which a sample was taken
- explain the meaning of "probability" and give examples of its use in today's society
- use counting techniques such as tree diagrams/ charts to determine the number of ways that an event can happen
- express the probability of the occurrence of a single event related to practical experience or a simple experiment.

D. LEARNING RESOURCES

BASIC LEARNING RESOURCES

Carli, Enzo, et al. *Consumer and Career Mathematics*. Second Canadian edition. Agincourt, Ontario: Gage Educational Publishing Company, 1991.

SUPPORT LEARNING RESOURCES

Support learning resources are identified in the *Program of Studies/Curriculum Guide* and *Teacher Resource Manual* (available for each IOP mathematics course from the Learning Resources Distributing Centre).

[illegible][illegible]

